

UND Space Education and Research Infrastructure

ND House of Representatives: Appropriations-Education and Environment Division
25 January 2023



National Security Initiative (NSI) Overview

- **Grand Challenge**
 - Strategic investment/opportunity areas
- **Personnel**
 - Strong, integrated team from across campus
 - Assoc. Vice President for Research
 - Adding Director and 8 faculty
- **Core Capabilities**
 - Space, Autonomy/Counterautonomy, Materials (inc. Micro/Nano), Quantum Tech., Rare Earth Elements
- **Strategic Partnerships**
 - Grand Forks Air Force Base, Grand Sky, Northern Plains UAS Test Site, Industry
- **Serve those who serve**



Nanofoundry

- Renovation of 1,000 sq. ft. facility with cleanroom is well under way.
- Will soon launch a search for a full-time technician (funded by UND).
- We are working to foster collaborations with industry partners.
- Raith (E-Beam) is planning a story about our investment. In the context of the CHIPS act, they think that our story will inspire other institutions.



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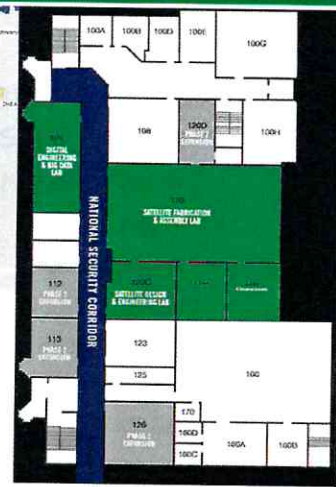
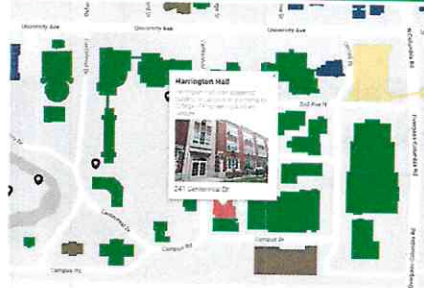
Advanced UAV & Satellite Material Lab

- \$1 million in instruments have been ordered, including a thermogravimetric analyzer, gas chromatogram – mass spectrometer, electron microscope, particle size analyzer, etc.
- Lab renovations are in the design phase
- These instruments, along with several existing instruments, will be operated as a cost center and made available for use by industry partners

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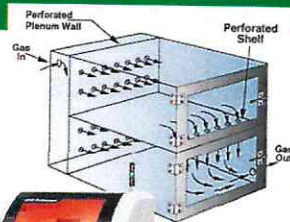
National Security Corridor

- Harrington Hall (1st floor)
 - Satellite Subsystem Development Lab
 - Cleanroom Assembly
 - Satellite Assembly & Test
 - Digital Engineering & Big Data Lab



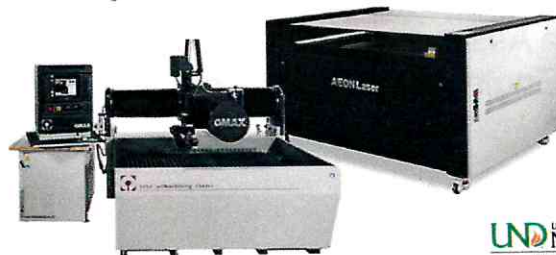
Satellite Component Assembly & Cleanroom

- Cleanroom
 - HEPA air handling, Vestibule, Nitrogen purge cabinet
- Satellite Component Design
 - Component fabrication, PCB fabrication equipment, Precision 3D printers, Solder/rework stations



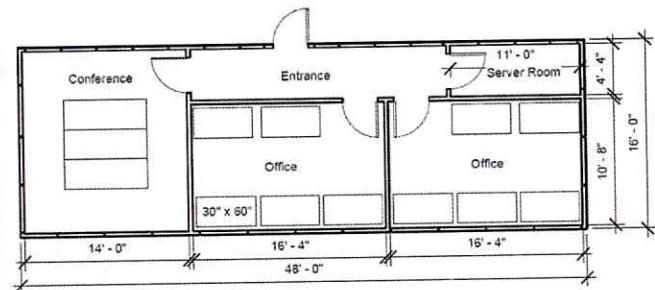
Final Satellite Assembly & Test

- Components
 - Space Systems Fabrication, Assembly, & Testing
 - Thermal/vacuum chamber
 - Shaker table
 - Laser cutter
 - Water cutter
 - Anechoic chamber
 - Millimeter wave antenna chamber



Secure Compartmental Information Facility (SCIF)

- Secure rooms for classified discussions/research



National Security Corridor Update

- Most equipment has been purchased/ready for installation
 - Some pieces of equipment are not yet delivered, but expected late spring.
- SCIF: Have an estimate. Expected to complete late summer.
- Renovation of Harrington Hall will begin late February. Expected to conclude late summer.
- Companies and government organizations are excited about the National Security Corridor and are ready to partner with us—examples include:
 - National Reconnaissance Office
 - Northrop Grumman
 - Packet Digital



Space Operations Update

- Space Operations Center/Classroom in Robin Hall - 95%
- Satellite Communications and Tracking
 - Odegard Hall Roof
 - Network connected
- Small Sat Build/Launch



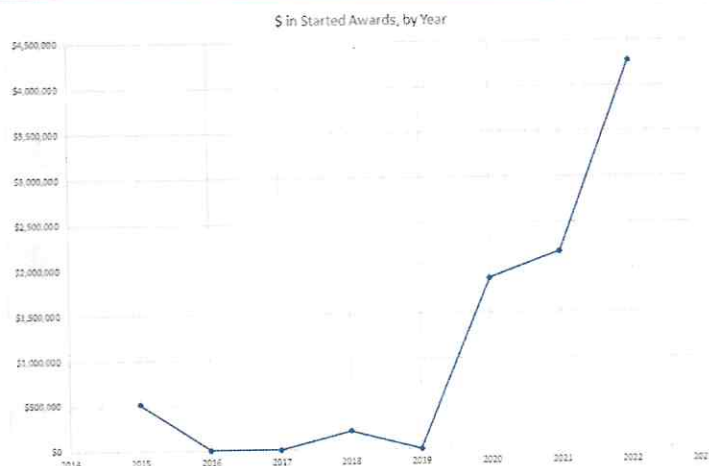
Expenditures Update

	Estimated Cost	Expenses posted	Encumbrances	Committed	Total
Satellite Operation Center	1,000,000	116,322	0	883,678	1,000,000
Digital Engineering and Big Data	300,000	168,070	557,675	52,238	777,983
Satellite Design and Engineering Lab	300,000	172,809	97,000	30,191	300,000
Satellite Fabrication and Assembly Lab, including Clean Room	2,400,000	120,871	2,508,684		2,629,555
Advanced UAV and Satellite Material Lab	5,700,000	2,006,073	5,084,901	401,488	7,492,462
Neutral Buoyancy Tank	1,200,000				0
Sensitive Compartmented Information Facility (SCIF)	1,500,000			600,000	600,000
Satellite and Space Debris Tracking	900,000				0
Laboratory Configuration	1,200,000			1,200,000	1,200,000
	*14,500,000	2,584,145	8,248,260	3,167,595	14,000,000



NSI Focus Impacts

- \$ in started awards for Dept. of Defense
 - Dept. Homeland Security and EERC efforts not in chart
- Impact of focus on NSI
 - Do not have estimates for Space Education and Research Infrastructure investment impact yet
 - In progress
- Potential \$50M-100M yr⁻¹



Space Future: Where UND Can Go From Here



Autonomous System Environment Development & Test Facility

- Critical needs
 - Rapid development
 - Controlled environmental testing (rain, fog, snow, etc.)
- Operational Context ↔ Simulation ↔ Laboratory ↔ Field Testing



- Integrated capability & controlled environment accelerate realization
 - Autonomous systems development factory



Controlled Environment Field-Testing Facility

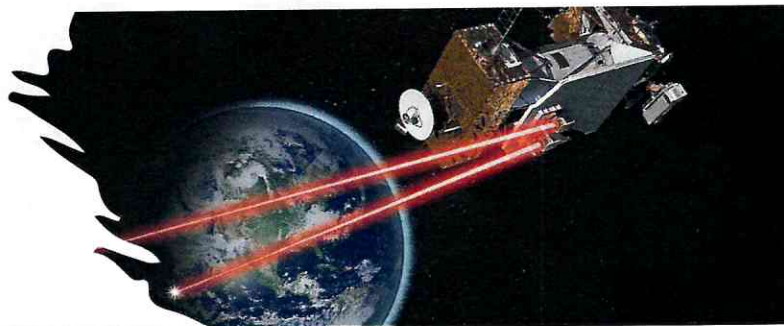
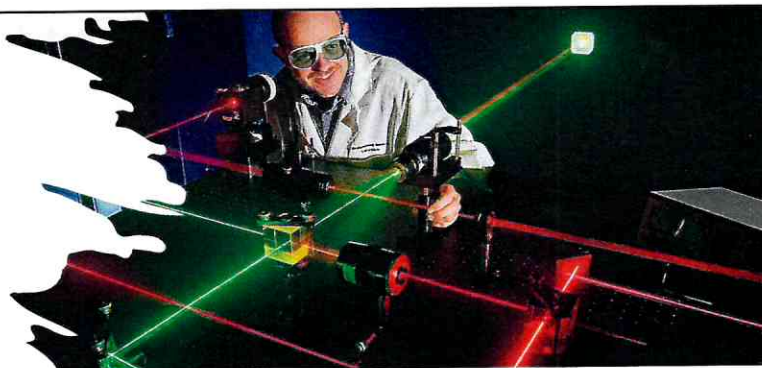
- Inflatable Dome for Space Station/Lunar/Mars Habitat and UAS Testing
- Allows Communication and GPS Reception
- Year-Round Availability
- Revenue Generating (Commercial UAS, Sports, Events)



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High-Speed Laser for Optical Communications

- Consistent message from Space Force and other potential space research partners:
 - Need fast, reliable, secure communication with high transmission rates in space.
 - Laser (optical) communications.
 - Communication spacecraft-spacecraft; spacecraft-aircraft; spacecraft-ground.

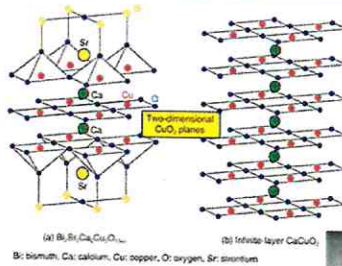


Molecular Beam Epitaxy

Create complex 2D and 3D semiconducting devices on the nanoscale.

Ultrahigh vacuum allows fabrication of devices that are not possible by any other means.

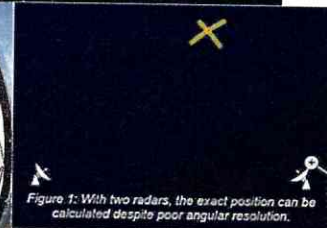
According to the Defense Advanced Research Projects Agency, such devices are essential for next-generation advances in artificial intelligence, autonomous systems and robots, and networked sensing.



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Satellite and Space Debris Tracking

- Space debris is a growing problem
- Placement of active RADAR on the roof of academic buildings allow us to detect and track debris
- Development of novel machine learning/deep learning models can identify small and distant objects



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Digital Engineering & Virtual Reality – DREAM Laboratory

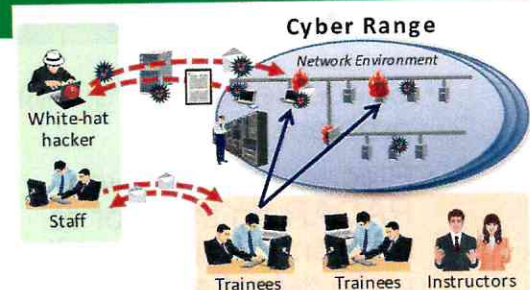
- The Partnership for **D**igital **R**ealism in **E**ngineering and the **A**pplied **M**etaverse (**DREAM**) – partners: NVIDIA, Lenovo, Ohio Supercomputing Center
 - NVIDIA/Lenovo OVX Double-Pod
 - New/upgraded servers/cluster to support data processing
 - Data Center power/cooling/infrastructure upgrade
 - DGX Pod
 - Upgraded display workstations, VR headsets, VR treadmills, motion capture



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Cyber Security Training & Research

- Cyber Range
 - Cloud-based resource to train cyber professionals to: Create and test different strategies, Master skills and techniques, Strengthen execution
- Cyber Research Infrastructure
 - Computational and stand-alone Network resources to develop novel and effective approaches to solve cyber security problems



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3D-Printed Rocket Components Lab

Will allow us to design, fabricate, and/or test:

- Novel 3D-printed rocket engine designs, injectors and turbopumps
- Engine material coatings for improved heat transfer
- Lunar and Martian metals for 3D-printed motors
- High-temperature performance of nanodevices

Will experiment with liquid and solid rocket boosters, potential to reach

Potential to partner with Grand Sky.

Development of the Space Workforce.

Currently 85 students in the UND
Advanced Rocketry Club.

